the diagnostic 120 and software 122 servers, modules for reformatting the system 312 and/or television content 310 areas, modules for scanning and verifying the integrity of individual files in the system 312 and/or television content 310 areas, and modules for re-installing appropriate program code modules from the backup copies held in the data modules 320 or downloaded from the diagnostic 120, software 122, or other remote servers.

[0036]   FIG. 4 is a flowchart illustrating the operation of the DVR 110 when performing error recovery according to an embodiment of the present invention. FIG. 4 represents only one of many possible variations of the error recovery behavior and those of ordinary skill in the art will recognize that alternative embodiments may omit illustrated steps, perform the steps in different orders, and/or add additional steps not shown in FIG. 4.

[0037]   Initially, the monitoring modules 316 are active and monitoring the state of the DVR 110. The monitoring modules 316 determine 412 whether to activate the recovery modules 318. This determination is made in response to the state of the DVR 110. For example, in one embodiment the monitoring modules 316 are activated when the DVR 110 is booted (i.e., powered-up) and the monitoring modules activate the recovery modules 318 if the DVR's power button (not shown) is pressed for a certain amount of time, e.g. 10 seconds. In another embodiment, the monitoring modules 316 are always active while the DVR 110 is active. For example, in one embodiment the monitoring modules 316 are executed as a background process and track the operations of the other modules. If certain conditions are detected, such as a hard drive read/write error or a

software crash or lockup, the monitoring modules 316 automatically activate the recovery modules 318. In an additional embodiment, the DVR 110 activates the monitoring modules 316 in response to certain other conditions and the monitoring modules 316 then decide whether the activate the recovery modules 318.

[0038]   If 412 the monitoring modules 316 do not activate the recovery modules 318, then the DVR 110 resumes (or continues) 414 normal operation. Otherwise, the DVR 110 preferably loads 416 and executes the recovery modules 318. The recovery modules 318 preferably execute the set of recovery procedures described below with respect to FIG. 5. If 420 the recovery procedures are successful, the DVR 110 resumes 414 normal operation. If 420 the recovery procedures are not successful, then the DVR 110 is unable to self-recover from the soft error. If the DVR is still capable of operation, one embodiment of the DVR 110 continues to operate (this condition is not shown in FIG. 4). If, however, the DVR 110 cannot operate normally, one embodiment halts 424 operation.

[0039]   If possible, the DVR 110 preferably displays information on the television 114 indicating the DVR's status. This information can take the form of text messages explaining the actions being performed by the DVR 110, such as "Contacting Server," "Downloading Software," "Fail Safe Recovery In Progress," or "Operation Halted Due to Unrecoverable Error." The DVR 110 can also indicate steps for a user to perform, such as calling a telephone service hotline or delivering the unit to a specific service center. In another embodiment, the DVR 110 controls the display of light emitting diodes (LED) (not shown) or another display on the DVR itself to indicate its status. For example, the

DVR 110 can cause the LED to blink a certain number of times to indicate an error code

or function being performed by the DVR.

[0040]   FIG. 5 is a flow chart illustrating details of the "execute recovery procedures"

step 418 of FIG. 4. As with FIG. 4, FIG. 5 represents only one of many possible

variations of the error recovery behavior and those of ordinary skill in the art will

recognize that alternative embodiments may omit illustrated steps, perform the steps in

different orders, and/or add additional steps not shown in FIG. 5.

[0041]   The recovery procedures preferably attempt to diagnose 510 the error or errors

suffered by the DVR 110. In one embodiment, the recovery modules 318 contain

program logic for identifying common errors. For example, one or more of the files in

the content 310 and/or system 312 area may be corrupt. The file system itself may also be

corrupt. Another possible error is abnormal fragmentation of files in the content 310 or

system 312 areas. Still another possible error is corruption to program modules or data in

the system area 312 that is undetectable at run-time and then causes further errors to the

DVR 110 when the program modules are executed.

[0042]   In one embodiment, the recovery procedures utilize the network interface 226

to communicate with the diagnostic server 120 in an attempt to diagnose 510 the source

of the error. For example, the recovery modules 318 may send the diagnostic server 120

log files, core dump files, program variables, user provided data, etc. The diagnostic

server 120 analyzes these data against known sources of error to identify the error. In one

embodiment, the diagnostic server 120 saves information about errors reported by the

DVRs 110 for later analysis.